Journal of Agriculture and Biological Sciences Vol. 3(1) pp.232-239, February 2012

Available online Available online http://www.globalresearchjournals.org/journal/?a=journal&id=jabs

Full length Research.

MORPHOMETRIC CHARACTERISTICS OF THE GIANT AFRICAN RIVER PRAWN, *Macrobrachium vollenhovenii* (Herklot, 1857) CAUGHT FROM WARRI RIVER COAST

Olele, N.F. and Kalayolo, P. E.

Fisheries Department, Delta State University, Asaba Campus Nigeria. P.O. Box 1110, Asaba, Nigeria.

GSM 08062905921. e-mail: florenceolele@Yahoo.Com.

Accepted 2nd October 2011.

Relationship between body parts and total length of *Macrobrachium vollenhovenii* was studied for six months. Quantitative data collected from the specimens were analyzed through power function, after logarithm transformation. A total number of 151 male and 245 female specimens were examined. This gave a proportion of 1:1.6 male to female sex ratio. Total length range for male specimens (4.80 to 20.90 cm) was higher than those for female (2.40 to 17.00 cm) specimens. Body weight range for females (4.60 to 61.60 g) was lower than the range (3.70 to 86.70 g) for males. The descriptive statistics derived from the measurements revealed that the percentage contribution of body parts for male specimens were generally higher than those for females, except for the tail and first to fifth leg lengths, where the values were higher in the later than the former specimens. Percentage contribution of body parts revealed that the highest percentage was contributed by the right antenna accounting for 18.13 %, while the left antenna also contributed 14.75 % both in female specimens. The highest percentage contribution for male specimens, was realized for the body weight accounting for 25.74 % followed by the body depth accounting for 14.55 %. Linear relationships between total length and lengths of various body parts revealed statistical significance ($p<0.05$) with varying 'r' values thus: right cheliped length for male (r =0.51), body depth for male (r =0.62), and carapace length for male (r =0.58). The 'r' values for the second, fourth and fifth male leg lengths were (r =0.56, r =0.58 and r =0.54) respectively. Other less significant values were observed for carapace length for female r =0.42 and, left cheliped length for female (r =0.43) etc. The significant relationships observed in the present study indicate that total length could reliably be used to predicted values of some body parts in male prawns caught in Warri River.

Key words: Morphometric, Characteristics, Giant, *Macrobrachium vollenhovenii,* Warri, River

INTRODUCTION

Quantitative measurement (involving lengths of carapace, tail, body weight and total length) was used to describe growth in crustaceans (Klaus and Gloria 1998). Such measurement was used to predict growths of body parts when linear regression was applied. Regression or equations models derived from such measurements were not only useful for data conversion but also as an index of intra- and inter-specific comparisons of morphometric characteristics of body parts.

Macrobrachium vollenhovenii, the Giant African river prawn, maintains a viable fishery in many places including most West Africa sub-regions, south eastern America, the Caribbean and south eastern United States (Klaus and Gloria, 1998). This species was a macro-invertebrate widely distributed, over coastal lagoons, estuaries and mangrove creeks of Nigeria (Cook *et al.,* 2002 and Anyanwu *et al.,* 2007). Abohweyere (2008) listed ten species of the genus from West Africa, when reporting on length/weight relationship and condition factor of *M. vollenhovenii*, *M. macrobrachium* and *Paneaus notiali*. Arimoro and Meye (2006) reported aspect of the biology of *Macrobrachium dux* in the Orogodo River where the abundance of the species in terms of number and biomass was determined. Both adults and juveniles specimens showed progressive increase in population from late dry season to mid rainy season. Other available information on taxonomy and biological parameters of prawns was reported by (Naiyanetr 2001; Mejia, *et al.*, 2003; Murphy and Austin 2005). Klaus and Gloria (1998) made a report on morphometric and reproductive traits of the tropical

Caridean Shrimps from University of Sao Paulo (USP) Brazil. The morphometric features of the rocky waterfall prawn from Erin-Ijesha in South-West Nigeria were also reported (Bello-Olusoji *et al.*, 2004). This later species belongs to the infra order Caridea, family Atyidae and genus *Caridina*.

The present study is an attempt to support and enrich already existing knowledge on the growth pattern of prawns. This will be achieved further through carrying out morphometric characterization of body parts of prawns caught in the Warri River Coast where such study was lacking. Researchers will thus be able to make reasonable predictions of the fauna in such locality for better management of the prawn fishery.

MATERIALS AND METHODS

Warri River was one of the most important coastal rivers of the Niger-Delta region of Nigeria. It took its source few kilometers away from Ubeji, lying within longitude $5^0.30^I$ to $5^0.40^I$ E and latitude $5^0.27^I$ to $5^0.32^I$ N (Figure 1). The River flows, South–West ward where the main channel joins the Forcados Estuary, finally empties into the Atlantic Ocean. The river covers a surface area of about 255 km^2 with a length of about 150 km^2, located in the rain forest region of Nigeria, where two recognizable annual seasons of variable durations: the sunny and the rainy seasons abounds, (Olomukoro and Egborge, 2004). The study sites are not entirely fresh water most periods of the year. During the sunny months (December-February) the water become brackish due to the incursion of marine waters from Forcados River. The reverse condition was the case during the rainy season.

Prawn specimens were collected from the commercial artisanal landing sites (at Soroghagbene, Jala and Ubeji, Figure 1) where they were purchased on monthly basis for six (6) months (March-August, 2010). They were transported in an ice chest to the Fishery Laboratory of the Delta State University, Asaba Campus and preserved in the freezer for later examination. Measurement of body parts was conducted with the Vernier Caliper and recorded to the nearest $\pm$ 0.01 cm, while body weight measurement conducted with the aid of a sensitive electronic balance (LP 302A LARK) was recorded to the nearest ($\pm$ 0.01 g). Examination and identification of specimens were conducted according to the classification keys of (FAO, 1981; Powell, 1982; Soumendra, *et al.*, 2009). Sex differentiation was based on morphology of endopod of the second pair of pleopods as reported by Deekae and Abowei (2010).

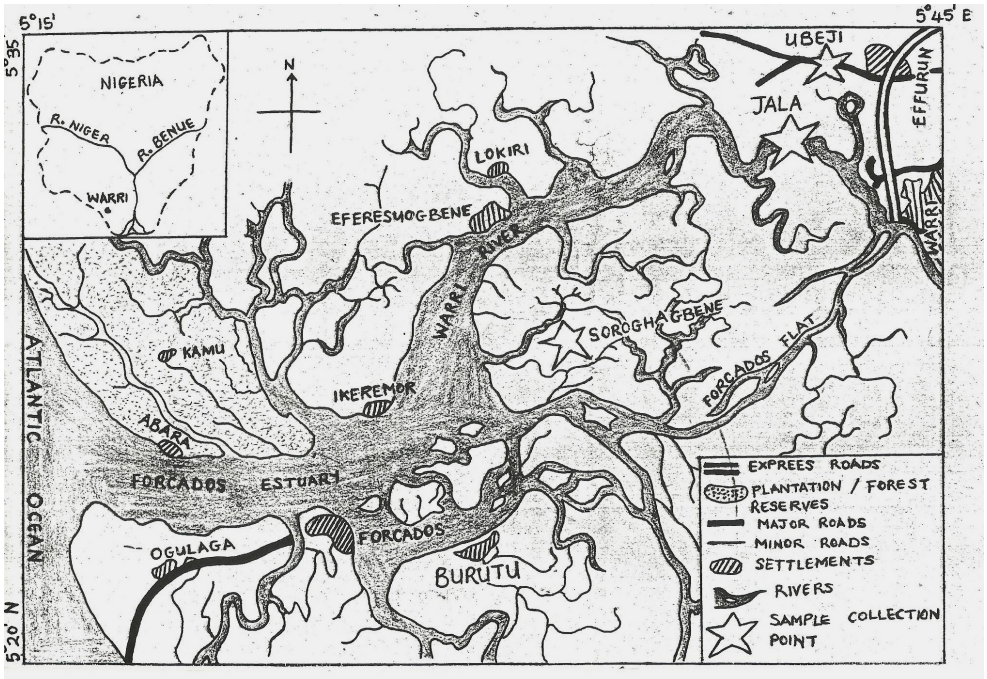

Figure 1: Map of Warri River and it's environ showing the regions (Suarogaene, Jala and Ubeji) where prawn samples were collected on monthly basis.

The morphometric relationship between total length and lengths of body parts viz: TL, SL, BW, RC_HL; LC_HL; LA_NL; RA_NL; **1ST** LL; **2ND** LL; **3RD** LL; **4TH** LL; **5TH** LL; BD; A_BL=; C_AL; T_FL was calculated by using a linear power function after logarithmic transformation of both dependent and independent variables after (Klaus and Gloria, 1998) as follows: where $Y= a^b$ was transformed logarithmically to log y = log a + b log. This computation enabled the prediction of the dependent variable from values of two or more independent ones.Percentage contributions of body parts were calculated with the formulae below:

100 (Length of body parts in cm) / Total length of the highest body parts in cm. (Hossain *et al*., 2009)

RESULTS

A total number of 396 specimens of *Macrobrachium vollenhovenii* compromising 151 males and 245 females were examined. This gave a 1:1.6 male to female sex ratio.

PERCENTAGE CONTRIBUTIONS OF BODY PARTS

Minimum and maximum values, standard deviation and percentage contributions of lengths of body parts, are shown in Table 1. The percentage contributions of body parts for male specimens were generally higher than those for females with an exceptions of the tail fin and first to fifth leg lengths, where the reserve was the situation for the female specimens (Table 1). The body weight (25.74 %) and the body depth (14.55 %) gave the highest percentage contributions for the male specimens while the right (18.13 %) and left (14.75 %) cheliped lengths made the highest contributions for the female specimens.

Table 1: Percentage contribution of body parts of *M. vollenhovenii* caught from Warri River

Parameter	Male				Female			
	Min	Max	Mean SD ±	% contribution	Min	Max	Mean SD ±	% contribution
TL	4.80	20.90	10.83 ± 2.25	6.20	2.40	17.00	10.24 ± 4.63	2.30
S L	2.90	17.80	9.48 ± 1.19	5.29	1.90	13.00	8.31 ± 1.57	1.76
BW	3.70	86.70	24.59 ± 16.33	25.74	4.60	61.60	17.10 ± 9.63	8.25
T_AL	0.60	2.70	1.74 ± 0.36	0.80	0.80	13.00	1.69 ±0.94	1.76
BD	2.00	49.00	4.81±3.48	14.55	1.60	47.00	4.67±4.42	6.36
A_BL	2.30	7.90	5.21±1.00	2.35	1.20	6.90	4.60±1.00	0.93
C_AL	2.20	12.90	4.97±1.23	3.83	2.00	47.00	4.54±2.88	6.36
RC_HL	1.20	18.60	10.09±3.41	5.52	3.60	65.00	8.51±4.37	8.79
LC_HL	3.60	20.80	10.37±3.44	6.18	1.80	19.40	8.54±2.79	2.63
RA_NL	3.20	28.20	12.25±5.22	8.37	1.80	134.00	11.25±9.13	18.13
LA_NL	1.50	28.30	13.27±4.74	8.40	1.20	109.20	11.92±7.73	14.75
1^{ST} LL	0.77	10.90	2.41±1.00	3.24	1.00	25.00	2.40±2.04	3.38
2^{ND} LL	1.50	8.90	4.84±1.14	2.64	1.70	46.00	4.66±3.88	6.23
3^{RD} LL	1.60	8.90	4.59±1.09	2.64	1.30	47.00	4.50±4.43	6.36
4^{IH} LL	0.90	7.10	4.42±1.04	2.10	1.40	43.00	4.17±2.62	5.82
5^{TH} LL	1.60	7.20±336.8	4.36±0.95	2.14	1.60	45.00±739.1	4.36±3.64	6.091

REGRESSION ANALYSIS

Table 2 shows the result of the regression analysis for females, males and combined sexes of *Macrobrachium vollenhovenii* used for the study. Data for analyzing both sexes were realized by combining equal numbers of male (151) and female (151) data. These were transformed into logarithm before their analysis. The graphs for the combined sexes are shown in figures 2 to 5. The pictorial representation of graphs for separate male and female specimens was not included in this manuscript because of space. Rather, their computed values are shown in table 2. Significant ($p<0.05$) 'r' values recorded for male specimens are as follows: right cheliped length (r=0.51), second leg length (r =0.56), body depth (r =0.62) and carapace length (r =0.58) Table 2.

Table 2: Linear regression between body parts and total length for females, males and combined sexes

Parameters	Female		Male		Combined sexes	
	R^2	r	R^2	r	R^2	r
RC_HL	0.146	0.382	0.257	0.51	0.164	0.41
LC_HL	0.185	0.43	0.202	0.45	0.193	0.44
LA_NL	0.032	0.179	0.067	0.25	0.038	0.19
RA_NL	0.024	0.15	0.122	0.35	0.048	0.22
$1^{ST}LL$	0.249	0.49	0.236	0.49	0.223	0.47
$2^{ND}LL$	0.132	0.36	0.308	0.56	0.173	0.42
$3^{RD}LL$	0.074	0.27	0.212	0.46	0.116	0.34
$4^{TH}LL$	0.012	0.11	0.333	0.58	0.158	0.39
$5^{TH}LL$	0.054	0.232	0.293	0.54	0.121	0.35
BD	0.089	0.298	0.378	0.62	0.24	0.49
A_BL	0.072	0.27	0.133	0.36	0.092	0.30
C_AL	0.177	0.42	0.341	0.58	0.083	0.29
T_AL	0.141	0.375	0.140	0.37	0.187	0.43

Key: R^2 = Coefficient of determination square, r = coefficience of determination, RC_HL=Right Cheliped Length; LC_HL= Left Cheliped Length; RA_NL= Right Antenna Length; LA_NL= Left Antenna Length; **1^{ST}** LL=First Leg Length; **2^{ND}** LL=Second Leg Length; **3^{RD}** LL= Third Leg Length; **4^{TH}** LL=Forth Leg Length; **5^{TH}** LL= Fifth Leg Length; BD=Body Depth; A_BL=Abdominal Length; C_AL=Carapace Length; T_AL=Tail Length.

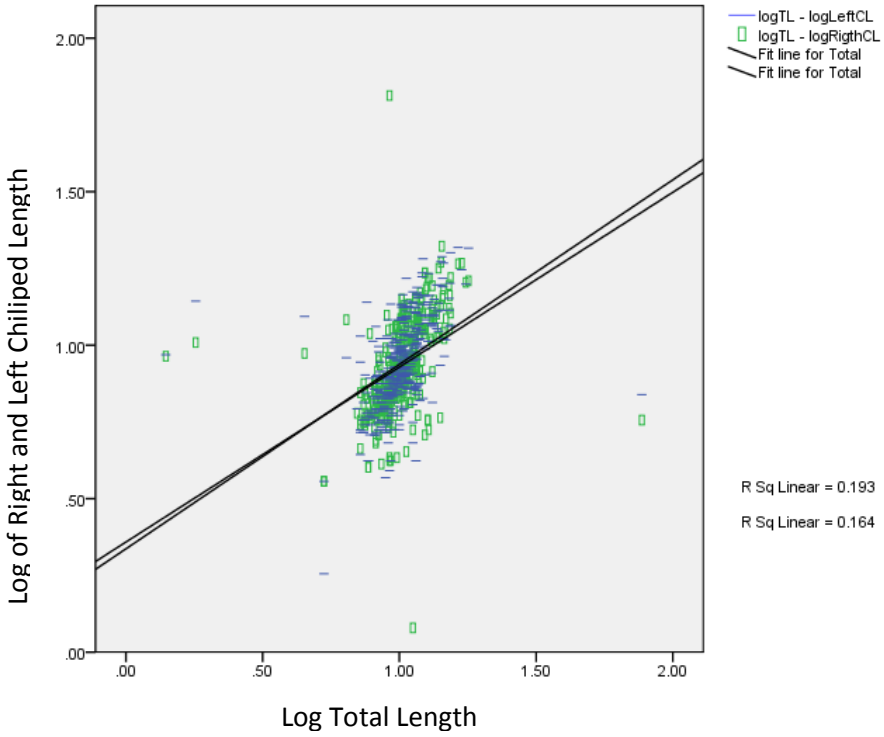

Figure 2: Regression Analysis between Total Length and Lengths of Right and Left Cheliped for the combined Sexes of *Machrobranchium vollenhovenii* used for the study

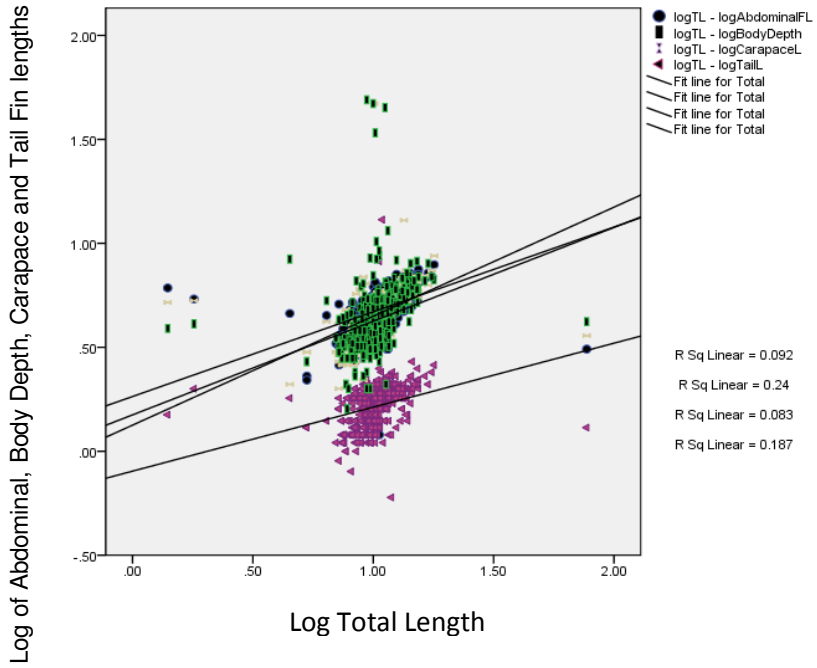

Figure 3: Regression Analysis between Total Length and Lengths of the Abdomen, Body Depth, Carapace and Tail Fin Lengths of the combined Sexes of *Machrobranchium vollenhovenii* used for the study

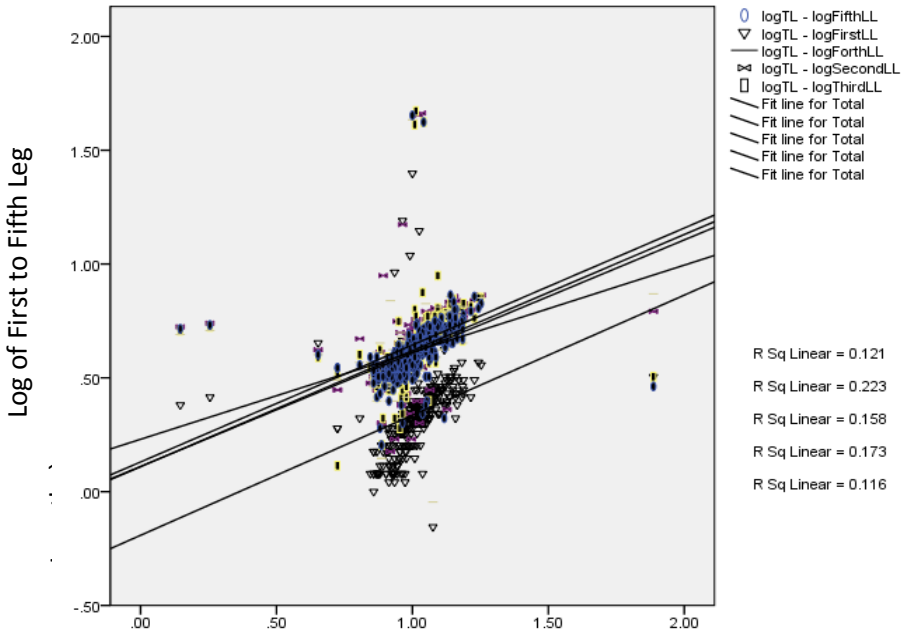

Figure 4: Regression Analysis between Total Length and 1st to 5th Leg Lengths of the combined sexes of *Machrobranchium vollenhovenii* used for the study

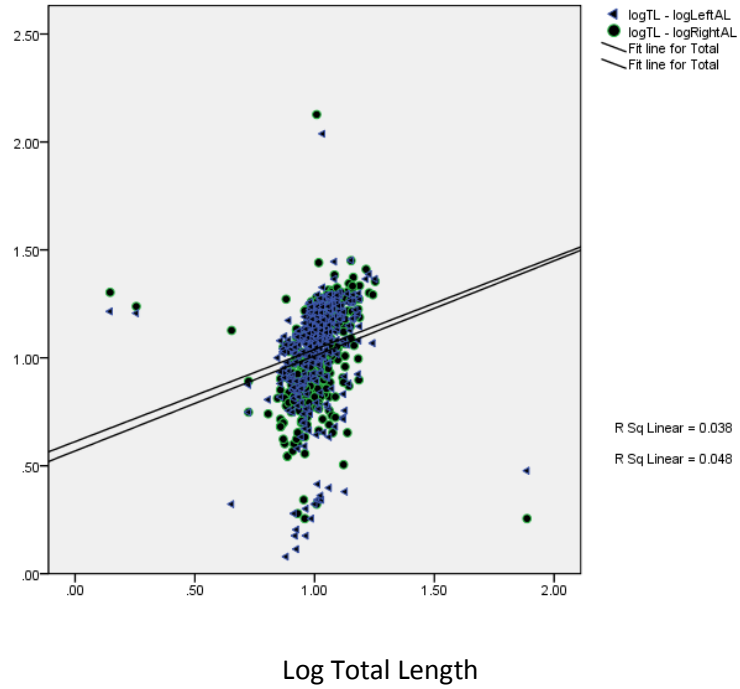

Figure 5: Regression Analysis between Total Length and Lengths of Left and Right Antenna for the combined sexes of *Machrobranchium vollenhovenii* used for the study

DISCUSSION

SEX RATIO

More female than male specimens,were encountered during the study. This observation may be explained by the fact that the preponderance of females to males may be a mechanism for perpetration of the species as reported (Motoh 1981, Marioghae, 1982, kavu, 1985 and Deekae and Abowie 2010). The present sex ratio may also be the result of natural selection.

The total length of prawns used for the study (Male =87.70 cm) and (female =61.60 cm) was not comparable with those reported by Deekae and Abowie 2010) where the largest males and females were 10.70 cm and 9.20 cm respectively. In New Calabar River, Mariogae, (1987) reported a maximum length of 13.80 cm while Rutherford, (1971) reported 12.5 cm. Mariogae and Ayinla (1995) observed that the maximum adult length in the Lagos Lagoon was 13.50 cm. In *Palaemon,* species, female specimens were larger than the males, while the opposite was the case for *Macrobrachium* species used in the present study. These differential growth patterns were reflected in the maximium total body length and weight measured for each species (Klaus and Gloria, 1998).

MINIMUM AND MAXIMUM VALUES, STANDARD DEVIATION AND PERCENTAGE CONTRIBUTIONS OF BODY PARTS OF *MACROBRACHIUM VOLLENHOVENII*

Observation on the minimum, maximum and standard deviation of body parts revealed that male specimens generally recorded,had higher values than their female counterparts. The same observation was recorded for percentage contributions of body parts of males (except for the tail fin and first to fifth leg lengths) where the result was higher for female than male specimens. These observations were in line with those of Klaus and Gloria (1998); Arimoro and Meya (2006); Yakub and Ansa (2007). Data on percentage contributions of various body parts in *M. vollenhobenii* was scarce. Available data on mean values and standard deviations was reported for *Palamenon northropii* (144±2.7); *P. panadaliformis* (18.6±3.0); *M. acanthaarus* (19.1±4.5) and *M. olferis* (21.7±6.6), Klaus and Gloria (1998). These values were not comparable with those of present study.

REGRESSION ANALYSIS OF *MACROBRACHIUM VOLLENHOVENII*

Morphometric characterization of body parts was a measure of growth quantified in terms of increase in body size. Klaus and Gloria, (1998) reported that total and carapace lengths were more reliable growth parameters than leg lengths.This report was at variance with that of the present study where the first to fifth leg lengths in males were reliable growth parameters. Corey (1991) also reported that carapace and tail lengths were reliable growth measures for body parts in prawns. Such report again was not in line with that of the present study. The later researcher was of the opinion that the relatively small size of the tail did not only make measurement difficult but also resulted in high residual error in the regression between other size dimensions and total length. According to Enin (1998), high and significant correlation was reported between carapace length and total length of two prawn species: *Nematopalaemon hastalus* (r=0.997) and *Macrobrachium macrobrachion* (r=0.979). Such results indicated that either part were reliable for establishing growth in the prawn. However, such report was at variance with that of the present study.

The body depth for males was the most reliable growth parameter in this study. Those for the females or both sexes combined cannot be relied upon. This observation was not in line with that of Abohweyere (2008) whose values were all statistically significant. Fagade, *et al.,* (1984) reported significant values for *Sarotherondon galilaeus.* Observation on the rate of increase for left antenna length for males was higher than those for females and both sexes in the present study. This observation was in line with those of Arimoro and Meya (2006); Yakub and Ansa (2007). The present study has shown that male specimens have more reliable mophometric parameter than those for females or both sexes combined for the evaluation of management procedures in prawn fisheries.

REFERENCES.

Abohweyere, P.O. (2008). Length-weight relationship and condition factor of *Macrobrachium vollenhovenii* in the Lagos – Lekki Lagoon system, Nigeria. *Nigeria Journal of Fisheries.* Vol. 5 (2) 98 – 106.

Anyanwu, P. E., Okoro B.C., Anyanwu, A.O., Matanmi, M.A., Ebonwu, B.I, Ayaobu – Cookey, I.K. Hamzat, M.B., Ihimekpen, F. and Afolabi, S.E., (2007). Length – weight relationship, condition factor and sex ratio of African mud catfish (*Clarias gariepinus*) reared in indoor water re-circulation system tanks. *Research Journal of Biological Sciences.* Vol. 2 (7): 780 – 783.

Arimoro, F.O. and Meye, J.A. (2006). Some aspects of the Biology of *Macrobrachium dux* (Lenz, 1910) Crustacean: Decapoda: Natantia) in River Orogodo, Nigeri delta, Nigeria. *Archive Biology.Colombia*, Vol. 12 (1) 111 – 122.

Bello-Olusoji A.O., Omolayo A.T. and Arinola A. (2004). Taxonomical studies on rocky freshwater prawns at Erin-Ijesha waterfalls. *Journal of Food, Agriculture & Environment*. Vol. 2 (3 & 4): 280 – 283.

Cook, B.D., Bunn, S.E., and Hughes, J. M. (2002). Genetic structure and Dispersal of *Macrobrachium australiense* (Decapoda, palaemonidae) in Western Queensland, Australia. *Freshwater Biology.* Vol. 47: 2098 - 2112.

Corey, S. (1991): Comparative Potential Reproductive and Actual Production in several Species of North American crayfish.-in: A.wenner and A. kuris, eds, Crustacean egg production, crustaceans issues. Vol. 7: 69-76.

Deekae, S. N., and Abowei, J.F.N., (2010). The recruitment pattern of *Macrobrachium macrobrachium* (Herklots, 1851) from Luubara Creek, Ogoni Land, Niger Delta, Nigeria. *Research Journal of Applied Sciences, Engineering and Technology.* Vol. 2 (6) 568 – 573.

Enin, U.I. (1998). The Macrobrachium fishery of the cross River estuary. *Nigeria Arch. Fish Mar. Res*. Vol. 46 (3) 263 – 272.

Fagade, S.O., Adebisi, A. A., and Atanda, A.N. (1984). The breeding cycle of *Sarotherondon galilaeus* in IITA Lake Ibadan, Nigeria. *Arch Hydrobiology.*Vol. 100: 493-500.

FAO (1981). Species identification sheetsfor fisheries purposes. East Central Atlantic fishing area. W. Fisher, G Bianchi and W. B. Scott.

Hossain, Y, Ohtom, J. and Zoader F. A. (2009): Morphometric, Meritics Charateristics and Conservation of the Threatened Fish, *Puntius sarana* (Hamilton, 1822) (Cyprinidea) in the Ganges River, Northwestern Bangladesh. *Turkish Journal of Fisheries and Aquatic Science.* Vol. 9: 223-225.

kavu, B. W. (1985). Macrobrachium macrobrachion (Herklots, 1851), its availability and effects of salinity on the growth of its juvenile. M. Sc thesis, Aquaculture, River State University of Science and technology, Port Harcourt/ Africa Regional Aquaculture centre, Port Harcourt, Nigeria. Pp: 96.

Klaus, A. and Gloria M.S. (1998). Morphometric and reproductive traits of tropical Caridean Shrimps from University of Sao Paulo (USP) Brazil. *Journal of Crustacean Biology*. Vol. 18, (4) 823 – 838.

Mejia, L.M. Alvarez, V.W. and Hartnoll, R.G. (2003). New Species of freshwater prawn, *Macrobrachium totonacum* (Decapoda, pacaemonidae) with larval development from Mexico. *Crustaceana.* Vol. 76 (1): 77 – 86.

Marioghae, I. E (1982). Note on the biology and distribution of *Macrobrachium vollenhovenii* and *M. macrobrachium* in Lagos Lagoon (Crustacea, Decapod, Paleamonidae). Review de Zoologie.Africaine, Vol. 96 (30): 493-508.

Mariogae, I. E. (1987). An appraisal of the cultivability of the Nigeria Palaemonid prawn. ARAC/87/WP/4/UNDP/FAO/NIOMAR. Lagos. Working Paper, pp: 12.

Mariogae, I. E. and Ayinla, O. A. (1995). The reproductive biology of cultured *Macrobrachium vollenhovenii* (Herklots, 1857) and *Macrobrachium macrobrachion* (Herklots, 1851) in Nigeria. NIOMAR technical paper No 100, pp 16.

Motoh, H. (1981).Studies on the fisheries biology of the giant tiger prawn *Penaeus monodon* in the Philippines. Southeast Asia Fisheries Development Commission. Technical Report, No 7. Tigbauan Iloilo, Philippines. Aquaculture Department, pp: 128.

Murphy, N.P., and Austin, C.M., (2005). Phylogenetic relationship of the globally distributed freshwater prawn *Macrobrachium* (Crustacean decapoda: palaemonidae): Biogeography, Taxonomy and the convergent evolution in larval development. *Zoologica Scripta.* Vol. 34(2): 187 – 197.

Naiyanetr, P. (2001). *Macrobrachium sirindhom.* A New Freshwater prawn from Northern Thailand (Decapoda, Caridea, palaemonidae) Crustaceana. Vol. 74: 609 – 616.

Olomukoro, J.O. and A.B.M. Egborge (2004): Hydrobiological Studies on Warri River, Nigeria part 11: Seasonal trend in the physiochemical limnology. Trophical freshwater Biology, Vol. 12/13 pp 9 -23. www.ajol.info.

Powell, C. B. (1982). Fresh and brackish water shrimp of economic importance in the Niger Delta. Proceeding of the 2rd Annual conference of the Fisheries Society of Nigeria. Calabar. 254-285.

Rutherford, A. (1971). Fresh water shrimp in the area of Cape Coast, Ghana. *Ghana Jour of Sci.* 11 (2): 87-91

Soumendra, N.S., Vijayanand, P and S. Rajagopal (2009) Length-weight relationship and relative condition factor in *Thenus orientates* (Lunal, 1793) along east coast of India. *Current Research Journal of Biological Sciences.* Vol. 1(2): 11-14.

Yakub, A.S. and Ansa, E.J. (2007). Length – weight relationship of the pink shrimp *Penaeus notialis* and giant tiger shrimp *P. monodon* of Buguma Creek in the Nigeria Delta, Nigeria. *The Zoologist.* Vol. 5: 47 – 53.